Project Title

Scale-Up and Demonstration of Fly Ash Ozonation Technology

Second Quarterly Technical Report
Reporting Period: July – September 2004

Principal Authors:
Larry LaBuz

PPL Generation, LLC
Two North Ninth Street
Allentown, PA 18101

Rui Afonso
Energy and Environmental Strategies
50 Old Faith Rd
Shrewsbury, MA 01545

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DISCLAIMER

This technical report was prepared with the support of the U.S. Department of Energy, under Award No. DE-FC26-03NT41730. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the DOE.

ABSTRACT

This is the second quarterly report under DOE Cooperative Agreement No.: DE-FC26-03NT41730. Due a number of circumstances, mostly associated with subcontractor agreements, the actual beginning of the project was delayed from its original award date of March 5, 2003. DOE's Project Manager was kept informed (verbally) by PPL's Project Manager throughout this period.

Because of this delay, this is the second quarterly report and it refers to the time period from July to September 2004. As the project is in its "design" stage, no results are available. This report summarizes the ongoing activities and provides an updated schedule.

No significant issues or concerns are identified.

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INTRODUCTION

Objectives

PPL has lost concrete marketability for much of its ash from the Montour power station due to high carbon content. The objective of the project is to demonstrate ash ozonation technology on a utility site, with minimum modification to existing plant equipment and operations and to confirm the process effectiveness through a complete battery of technology performance and concrete quality tests, to develop a plan for effective implementation at the PPL Montour station and for technology transfer to other U.S. coal-fired plants.

EXECUTIVE SUMMARY

Scope of Work

Based on the results of pilot testing performed during the Spring/Summer of 2002 at the Fuller Bulk Handling (FBH) test facility, the project team determined that air merge blending is the technology of choice for fluidization/ozonation of fly ash. In Task 1 of the project, the technology will be deployed and tested at PPL's Montour Steam Electric Station, where it will be integrated with existing ash handling systems. In Task 2 technical and economic analyses will be conducted for a full-scale, commercial design of the technology. Task 3 is proposed as a "documentation" task and will produce a Final Report to DOE. These tasks are described below in more detail.

In this project, PPL will supply a continuous stream of the high-carbon problem ash, as well as ash handling equipment at the station (e.g. silos, fans, etc.). Ash from other (non-Montour) sources will also be obtained and tested to evaluate the influence of different ash parameters on the effectiveness of the ozonation technology. PCI will supply a new SMA50 ozone generator capable of treating large quantities of ash. A matrix of contacting conditions and carbon/ozone stoichiometries will be tested and the results compared. Concrete testing of treated ash samples will be performed by CPM and supporting analyses of the ash will be carried out at the Brown University research laboratories. A plan will be developed for implementation of the optimal process at Montour and for technology transfer to other U.S. generating plants. Finally, design guidelines will be developed to allow for an effective "jump" into commercial development.

EXPERIMENTAL

Tasks Description

The proposed scope of work will be broken down into the following major tasks:

TASK 1 – Design/Deploy/Test semi-commercial fluid bed system at Montour Station

Objective – Conduct semi-commercial scale test of fluidization/ozonation of fly ash at PPL's Montour Station using FBH's Airmerge™ blender and PCI's ozonation technologies. Building upon previous tests and development by the project team, FBH will design and fabricate a 42" diameter Airmerge™ batch blender for gas/solids contacting. PCI-Wedeco will supply a new SMA50 ozone generator capable of producing 100 lb/day of ozone operating on air. The system will be integrated with existing ash handling systems at Fly Ash Storage Silo #1 at PPL's Montour Station, as illustrated in Figure 1. Off-gases will be pre-filtered and sent to an ozone destruct unit prior to discharge to atmosphere. FBH will complete the installation approximately 5 months from the start of the project.

Six fly ashes of varying characteristics will be tested in the system to develop a range of system operating parameters. The installed system will accept ash from the silo, "ozonate" the ash in batches, and loadout the ash to PD rail cars through an existing airslide. This streamlined material flow will allow for ash throughput of about 10 tons/day. Testing is anticipated to last approximately four months.

The following activities, or subtasks, will be conducted in this task.

- Design and fabricate 42-inch Airmerge™ blender and SMA50 ozone generator.
- Prepare test matrix.

- Deploy fluidization/ozone generator system.
- Interface with Montour ash handling systems (storage silos, dry ash loadout, etc.)
- Conduct parametric tests
    - Operating parameters
        - *bed height,*
        - *fluidization/aeration velocities*
        - *vibratory fluidization enhancement*
        - *raw ash quality (different sources and carbon content)*
        - *ozone reaction stoichiometry (gm-ozone/kg-ash)*
- Conduct ash and concrete analyses (foam index, mortar air-entraining tests, petrography, trial batches for short and extended mixing times)
- Results documentation
- Reporting to DOE

TASK 2 – Design Full Scale-up for Montour Station and Development of Generic Design Guidelines

Objective – Develop design modifications for the full scale-up of the ash fluidization/ozonation system based on overall performance considerations from Task 1. This will serve to demonstrate low-cost retrofit potential to existing systems at normal operating conditions. Develop generic design guidelines addressing technical and cost considerations, for commercializing the technology. The following activities, or subtasks, will be conducted in this task.

- Design modifications for existing systems
- Develop design guidelines for wide-applicability ozonation systems
- Cost/Economic analyses
- Results documentation
- Reporting to DOE

TASK 3 – Final Report

Objective – Provide full documentation of project results and develop design guidelines, cost estimates commercialization potential for the technology. This will include:

- Design criteria
- Performance expectations
- Cost
- Applicability
- Deployment and operation

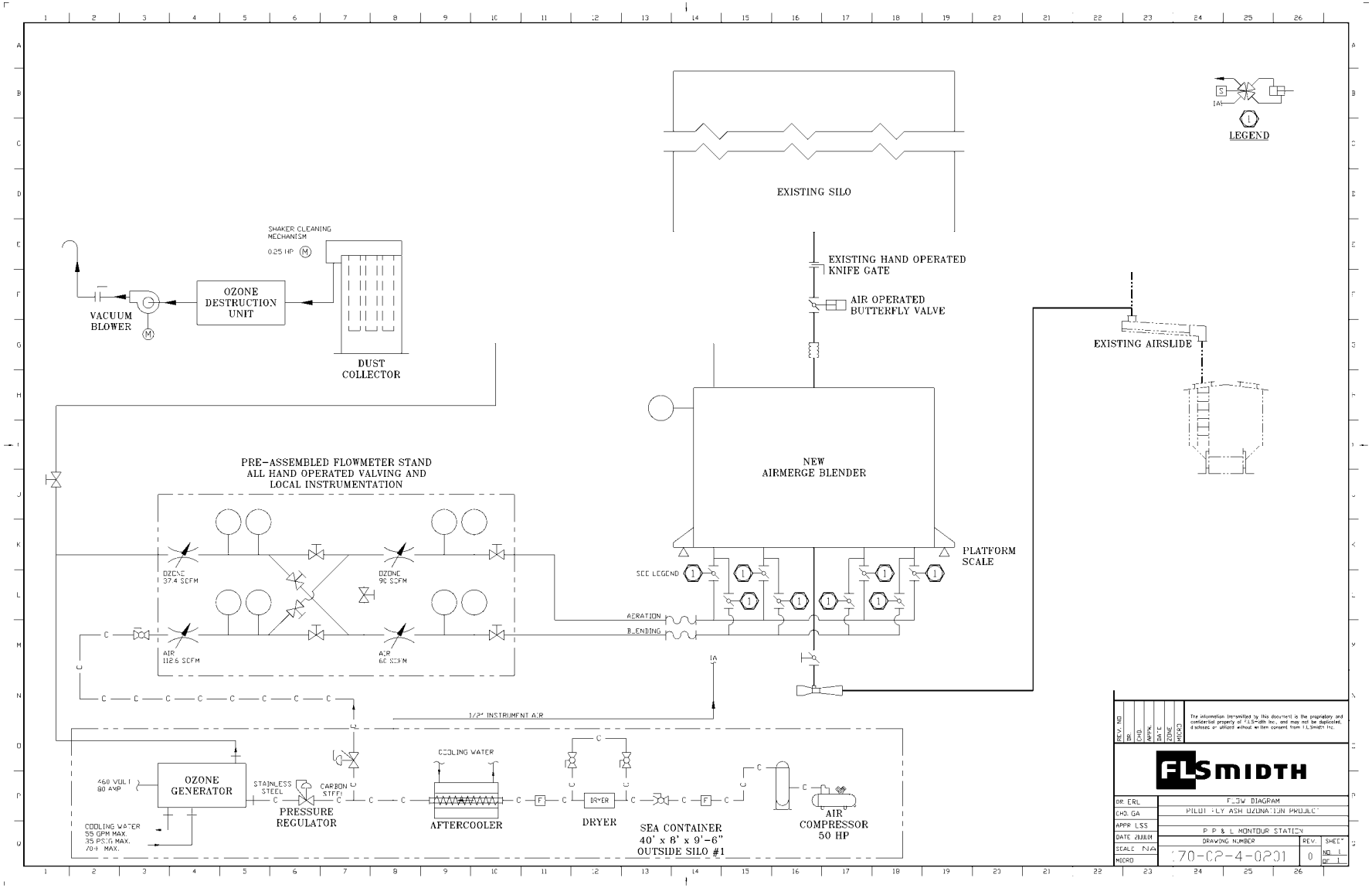

Figure 1 - Task 1 Semi-commercial scale installation of fluidization/ozonation technology at Montour (revised)

RESULTS AND DISCUSSION

The project has progressed on schedule and without any significant issues of concern throughout this quarterly period (July – September). The project manager has monitored progress and performance through dedicated and thorough meetings/conferences calls with the principals of the project team on a scheduled monthly basis, as well as additional informal discussions as appropriate.

A revised schedule is presented in figure 2. This revision reflects the delay in the actual start date of the project, as discussed in the first quarterly report. Key near-term milestones include the planned installation of the system at Montour in January 2005 and the planned parametric testing in early 2005.

Key discussions/issues during this period are summarized below.

August conference

- EES/Brown U. discussed the test matrix and supervision plan. EES/EPRI/Brown will work with PPL to develop a formal and detailed test plan. It is necessary to confirm a number of variables before a test matrix with detailed "numbers" can be finalized. Namely, the ashes to be tested need to be confirmed before detailed values for key test parameters (e.g. ozone stochiometry, fluidization velocity, etc) are finalized. R. Hurt will update previous general calculations that were performed during the proposal stage as a starting point. The plan for finalizing the test matrix includes an effort to determine and "procure" the test ashes. This effort will be coordinated through Larry LaBuz. Once this is completed the test matrix will be finalized. It was proposed to target early to mid October as the time frame for this task.
- Ash testing was addressed by Brown and CPM. Reference ashes will be tested sought and tested for baseline reference. Reference ashes will be those of proven acceptability in one or more concrete markets. R. Mackow addressed the issue of using an on-site "lab" for the concrete testing for purposes of expediency and cost effectiveness. The need is for about a 20'x 20' area with warm water access and a "garden hose" for cleaning.

- Air permit drawings to be finalized and sent to PPL by mid-late August.

- Ozone information package already sent to FLS. Updated drawings being finalized. This will include info on weight bearing for floor support requirements.

- Cooling water requirement/supply was confirmed. Existing drain (gravity) capability is adequate.

- Site Visit Summary – No problems identified or discussed. Concrete pad no longer planned as gravel bed is preferred. Equipment grounding was addressed and it should not be a problem. Equipment dismantling and removal after the program was also addressed. FLS will disassemble and put in shipping containers.

September conference

- Ash Sources – the selection and procurement of the six (6) ash sources for the test program is underway. A preliminary selection as been defined as follows:
    - Montour hardgrind (1), regular grind (2), blend (3)
    - Dairyland Power Class C (4)
    - Dairyland Power Class C/Montour Class F blend (5)
    - Class F w/ activated carbon (6)

- Test matrix – test matrix definition underway. Preliminary parameters have been identified. Final operating parameters will be determined when ash selection is finalized.

- Schedule – No significant schedule delays or other concern are identified at present. The Ozone generator delivery date has been pushed back by about 2-4 weeks from the original plan. However, this should not have negative impact on the overall project schedule. At present, it still planned to initiate ash testing on site in January 2005 as shown in figure 2.The following represents the current projected near-term, key milestones
    - Ozone Generator delivered to FL Smidth – late November
    - Delivery of all Equipment to Montour – early – mid December
    - Installation – complete by 1/31/04
    - Testing – February/March 2005

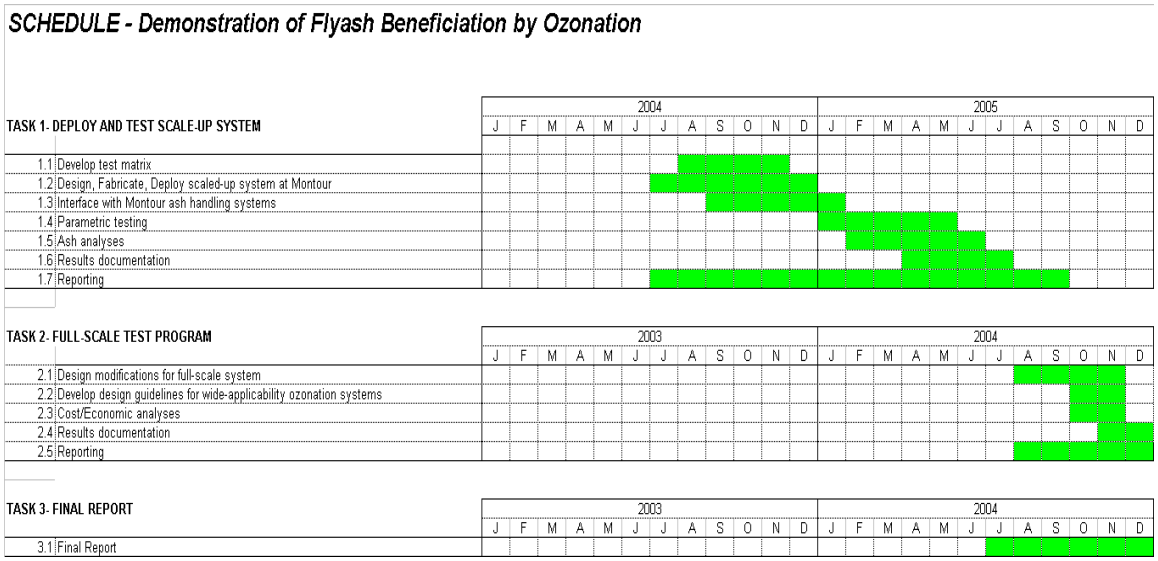

Figure 2. Revised Schedule

CONCLUSIONS

No conclusions for this reporting period.

REFERENCES

None for this reporting period.

LIST OF ACRONYMS AND ABBREVIATIONS

DOE	Department of Energy
ESP	Electrostatic precipitator
FGD	Flue gas desulfurization
ID Fan	Induced draft fan
cfm	Cubic feet per minute
kW	Kilowatt
MW	Megawatt
NETL	National Energy Technology Laboratory
O&M	Operating and Maintenance
PC	Pulverized coal
PRB	Powder River Basin
FBH	Fuller Bulk Handling Division
PPL	PPL Generation, LLC
EPRI	Electric Power Research Institute
EES	Energy and Environmental Strategies